



U.S. Department of Energy
Energy Efficiency and Renewable Energy

Hybrid Applications in the Federal Energy Management Program

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FEMP Mission

Lead by Example. FEMP works to increase energy security and reduce the cost and environmental impact of Government by

- advancing energy efficiency and water conservation,
- promoting the use of renewable and distributed energy, and
- improving utility management decisions at Federal sites.



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Hybrid Role in FEMP Model

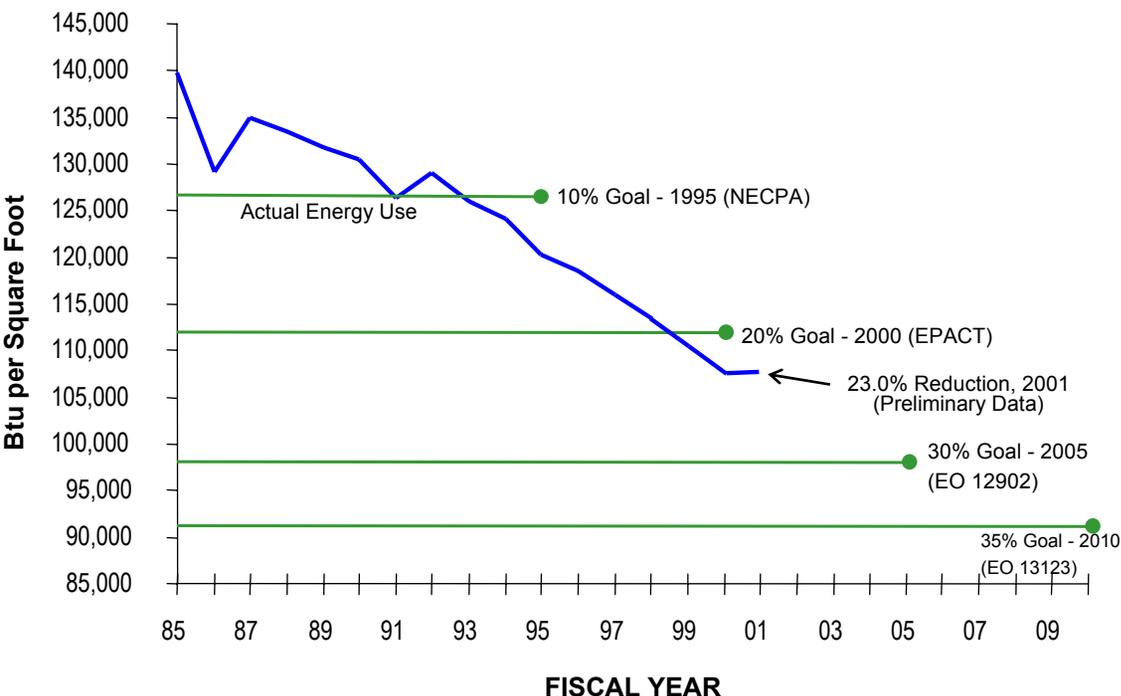
- Set goals
- Plan and implement projects
- Measure performance
- Report progress
- Reward Federal leadership



Progress To Date

- Preliminary FY 2001 data indicates the Federal Government exceeded the FY 2000 goal by 3.0%

Standard Building Energy Reduction Goals

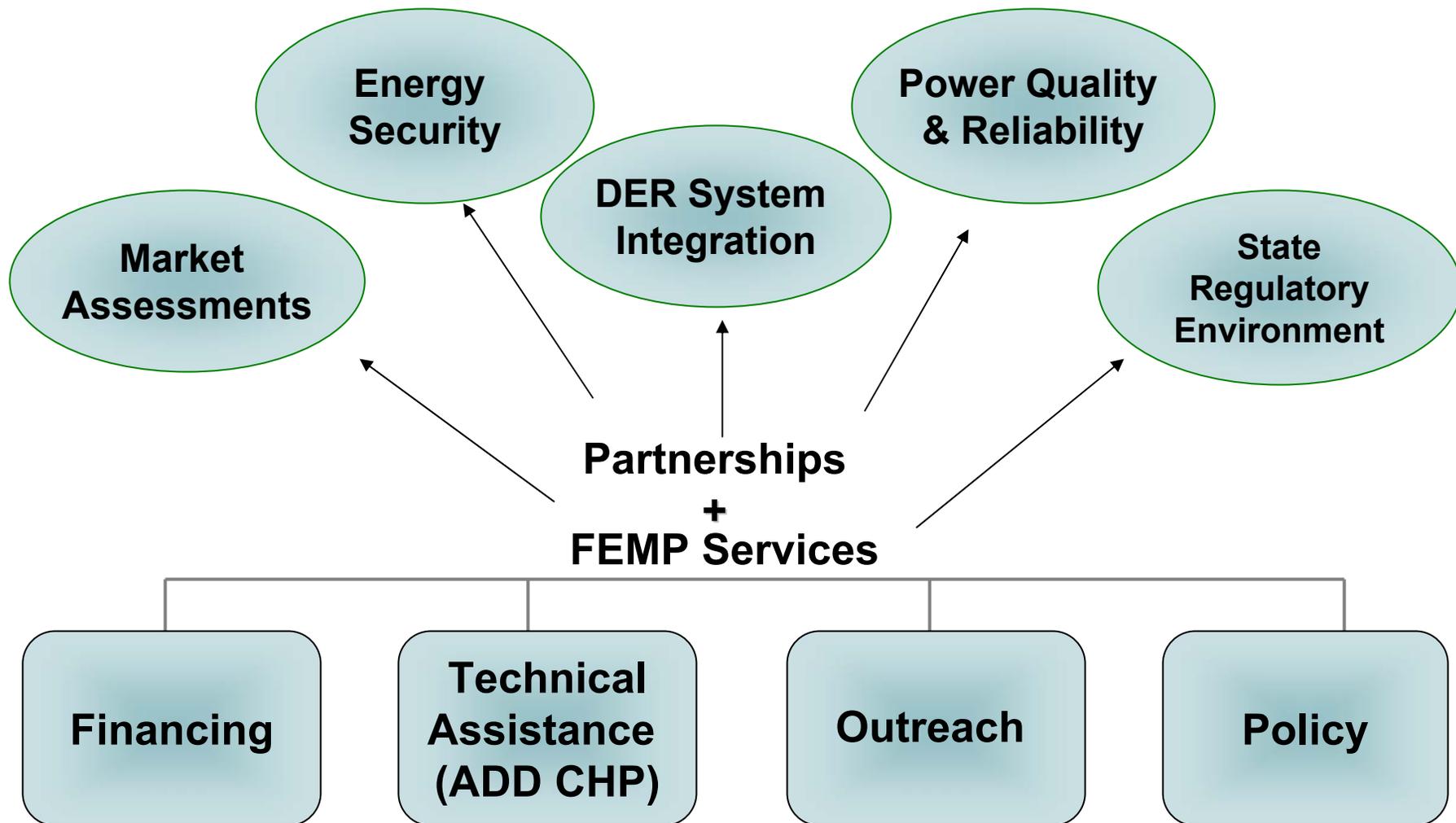


- In real dollars, the Government spent \$1.4 billion less for energy in its buildings in FY 2001 compared to FY 1985.
- Approximately half of these savings are from energy improvements.
- 23.0% reduction is based on Btu per square foot



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FEMP Services Help Target Opportunities





FEMP

- Promotes actions that help accomplish core goals
 - Reduce costs, emissions and energy use
- Offers federal agencies unbiased information on options
- Helps identify best-value solutions (and sources of financing if needed)



FEMP Tech Transfer

Helping Move EERE Technology to the Marketplace

GHP retrofit of 4000 homes at Fort Polk, LA, 1996. Reduce kWh use 33%, eliminate natural gas use altogether. FEMP roles included:

- 1) Validate field performance and savings (ORNL);
- 2) Promulgate results - Federal Energy Showcase Award 1997.

Issue GHP Construction guide specifications 1999

Outcome: More than \$100M investment in GHPs in Fed facilities 2001-2002, > than total investment in previous 10 years

Geothermal Heat Pump

Initial Information: Federal Tech Alert 1995

Alternative Financing. FEMP issues Technology-Specific Super ESPC in 1998 for GHP. 5 contractors selected.

EERE Emerging Technologies

Residential Heat Pump Water Heater

Electrochromic Windows

Solid State Lighting

1990

2000

2010



Objective Analysis

- **Technologies must meet customer needs**
- **FEMP shares “lessons learned” across sectors and agencies**
- **Technologies should be**
 - **Proven and commercially available**
 - **Life-cycle cost-effective**
 - **Reliable**



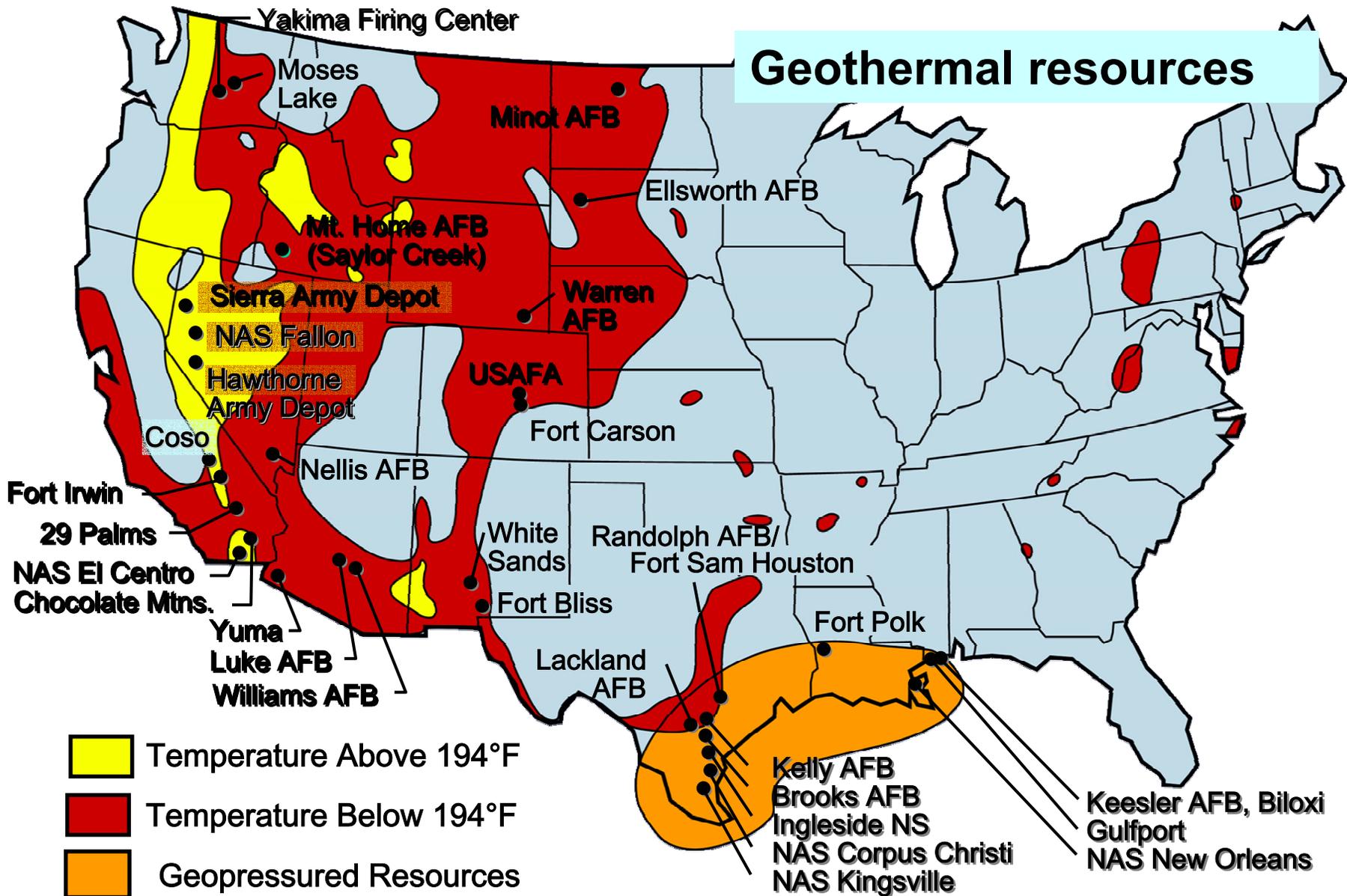
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Sharing Analytical Results

- FEMP develops data sets on the costs and benefits of important conservation technologies
- FEMP facilitates partnerships with the private sector for project development and financing
- FEMP Representatives in Regional Offices are point of contact for agency requests
- National Labs, “core teams” and other experts support regional offices and project facilitators



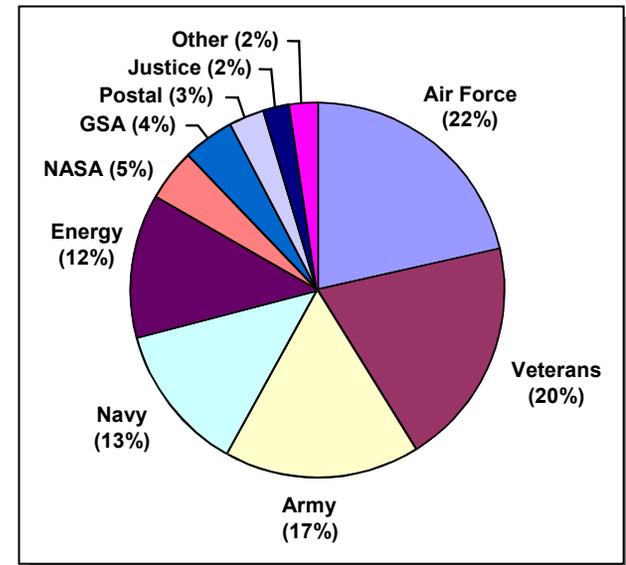
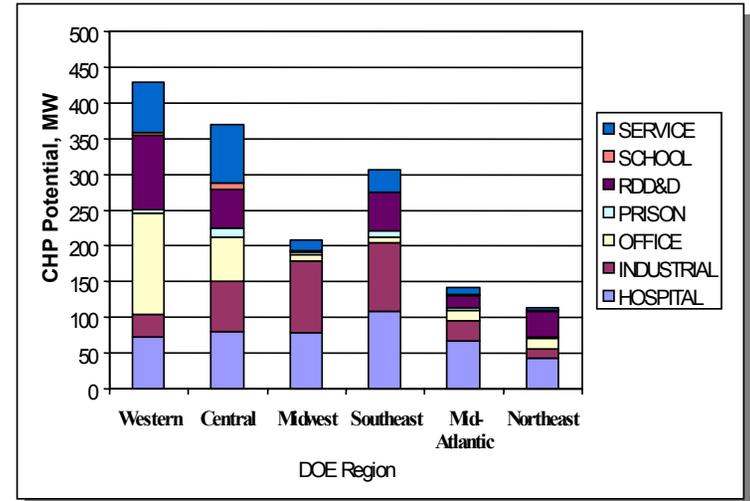
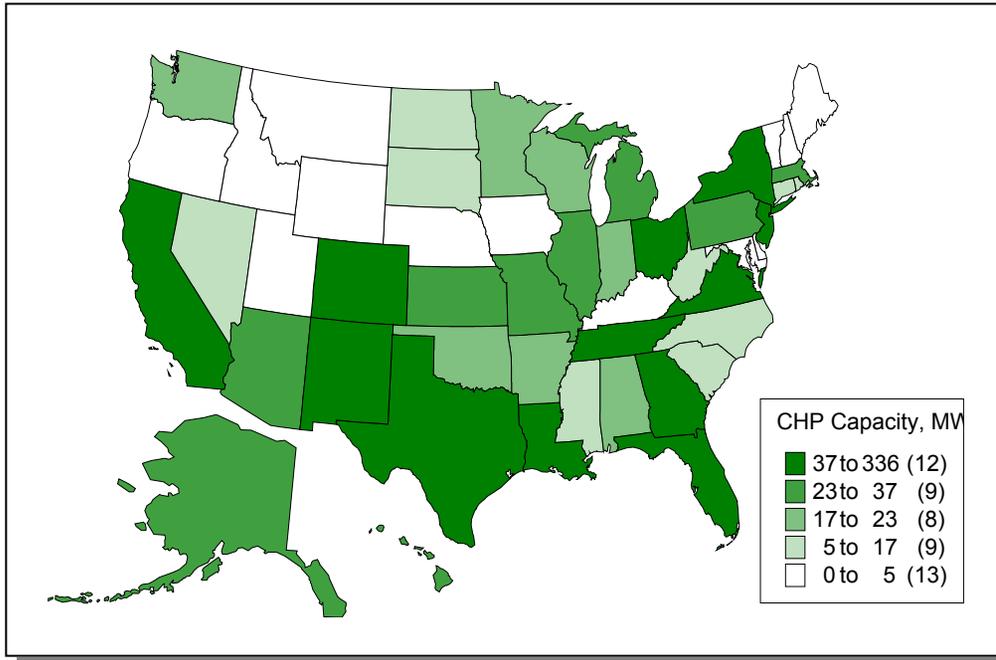
FEMP Helps Agencies Identify Options





Distribution of 1600 MW of CHP Potential

FEMP Market Assessment, 2002





Remote Applications

- Hybrids historically used in off-grid applications
- Example: Remote FAA aircraft navigation beacons need energy
- Example: Chandalar Lake in Brooks Range, northeast AK.
- Accessible only by air
- Previously powered by diesel generators--fuel flown in.
- Now 100% renewables
- Two 7.5 kW wind turbines and 5 kW solar array





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Remote Applications for Defense

- **Example—Weapons Ranges**
- **Such as Naval Air Weapons Station, China Lake**
- **PV/Diesel Hybrid System**
- **Similar system at Santa Cruz Island**





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Hybrid Opportunities Growing for Energy Security

- **Market changes and 9-11 have sites looking for increased reliability to support critical missions**
- **Especially true for large sites served by vulnerable distribution systems**
- **Example: Marine Corps AGCC in Mohave desert—at end of long power line**



**Air Ground Combat Center
Twentynine Palms, CA (USMC)**



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Combined Heat and Power System at Twentynine Palms

- **With alternative financing—no need to wait**
- **FEMP catalyzed efforts and contributed to efficient design**
- **7MW, dual-fuel CHP system provides energy security and improved power quality**
- **Exhaust heat used for district hot water and chiller**
- **75% efficiency —twice U.S. grid average**
- **CHP not only paid for itself from savings...**



CHP System Inaugurated Feb. 28, 2003



CHP Cost-Savings Permit Large PV Investment in Mojave Desert

- **CHP savings—\$5.8M/yr—help subsidize 1.1 MW (8 acres) of PV**
- **High electricity costs improve economics**
- **PV system helps off-set peak power demand and can contribute to critical loads in emergency**

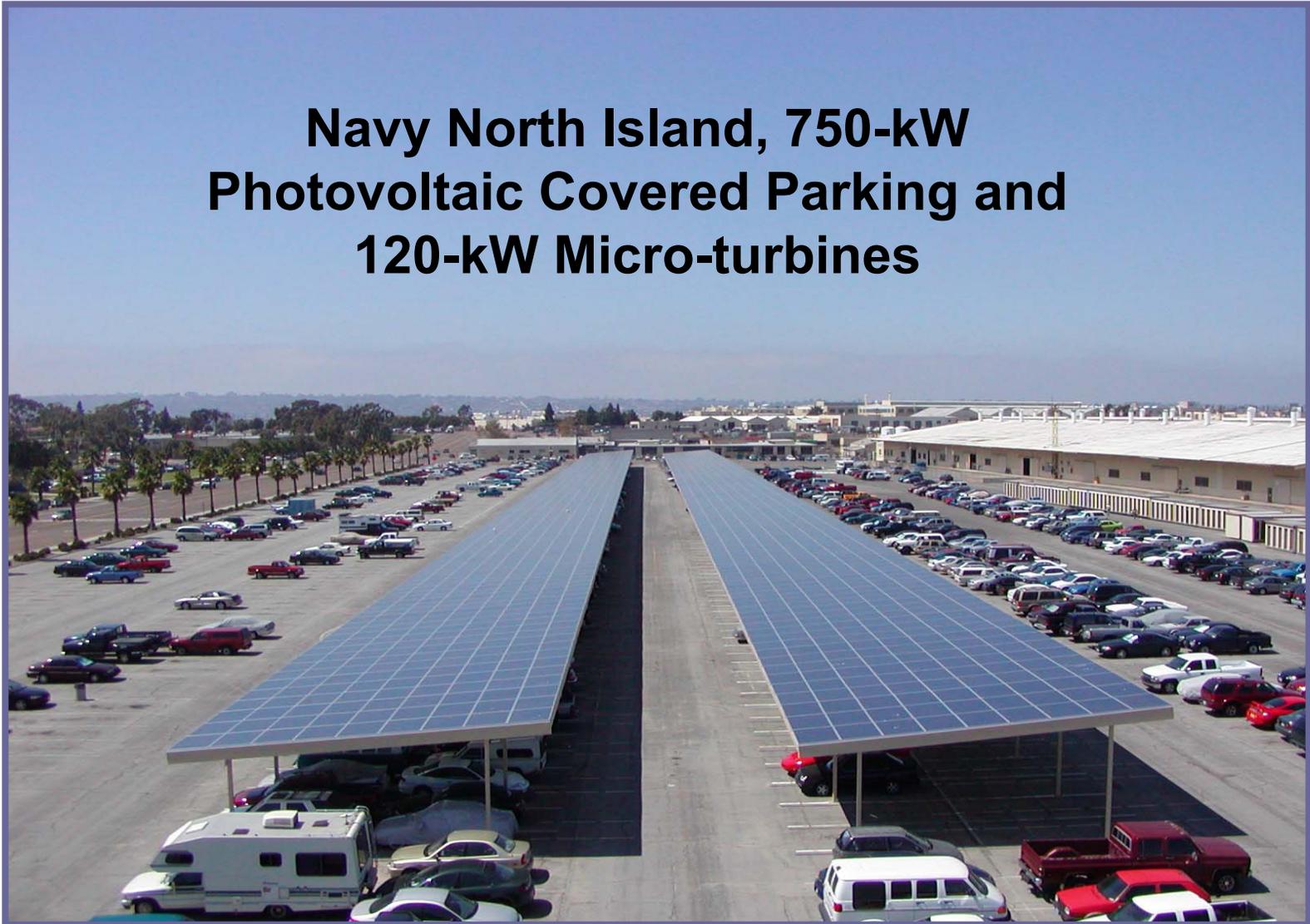




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San Diego: PV and CHP for Cost Savings and Reliability

**Navy North Island, 750-kW
Photovoltaic Covered Parking and
120-kW Micro-turbines**





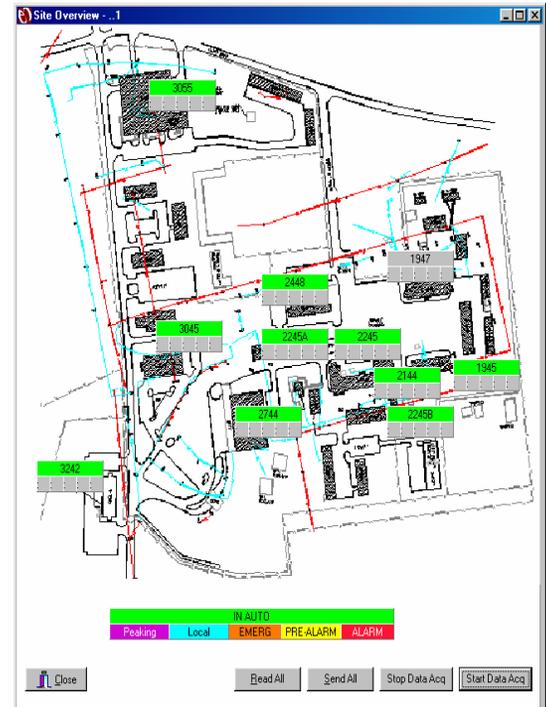
Micro-Grids—Catalyst for Hybrids?

Army Fort Bragg: Microgrid interconnects and controls multiple Gensets, from 5-kW fuel cell to 5000-kW CHP

Microgrid Advantages

- ✓ **If utility power fails, generators serve emergency loads & are isolated from the grid**
- ✓ **Each generator can be dispatched for economic purposes, responding to utility price signals for**
 - ✓ **Peak shaving (demand management)**
 - ✓ **Time of use (TOU) tariffs—if price rises above preset level, on-site generator switches on**

11 Facilities each with gensets





Fort Bragg Microgrid

On-Site Generation Has

- ✓ **Enhanced energy security through disperse and diverse strategy**
- ✓ **Lowered utility-supplied energy costs**
- ✓ **Created bi-directional power flows on the distribution system**
- ✓ **Created value for the host utility, Carolina Power & Light**
- ✓ **Allowed optimization of dispatch sequences**

Moving Forward

- ✓ **Will integrate a 5 MW gas turbine; dual fuels & additional backup generators to the microgrid**
- ✓ **Additional generation components are easily networked at low cost**
- ✓ **Microgrid and automated management can facilitate integration of intermittent renewable sources (wind, solar)**



FEMP support of DER paves way for hybrids

- **Today's projects (such as CHP) provide physical infrastructure for clean technologies of tomorrow (Hydrogen, fuel cells, hybrids)**
- **DG/CHP builds knowledge and institutional capability to manage on-site power systems**
- **New technologies are deployed when**
 - **Cost-effective**
 - **Increase efficiency and reliability**
 - **Reduce emissions**



DG/CHP Trends

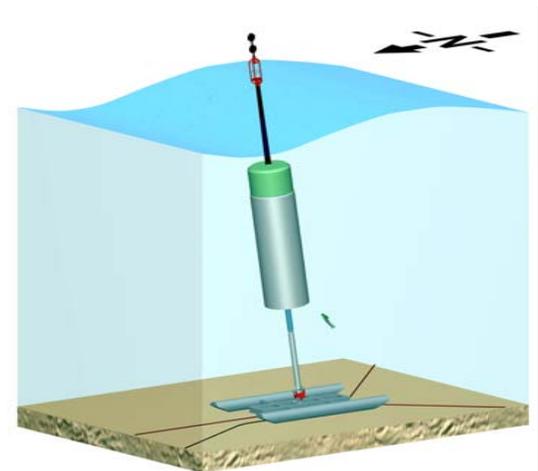
- Private partners and financing
- Business approaches
- High returns on CHP can subsidize cost of renewables
- Energy security and micro-grids
- Systems that are
 - Cost-effective
 - Reliable
 - Simple



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What Does the Future Hold?

- **More Diversification for security and reliability**
- **Continued role of private partners and financing**
- **Continued federal support to lead by example—**
- **Navy Renewable Initiatives:**
 - **2- to 3-MW solar/hydrogen Energy Park at Naval Station Pearl Harbor**
 - **Wave power electric generators at Kaneohe Marine Corps Base, Hawaii**





Conclusions

- **FEMP focus is on technology transfer and deployment that helps agencies achieve goals**
 - Reduce costs, emissions and energy use
- **FEMP offers federal agencies unbiased information on options, including hybrids**
- **FEMP helps identify best-value solutions to meet customer needs**



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FEMP Contacts

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